

WHITE PAPER



# MOTOROLA'S WIRELESS NETWORK INDOOR/OUTDOOR SOLUTION



**EXECUTIVE SUMMARY:**

IDC Research estimates that the mobile worker population will reach one billion worldwide by 2011, accounting for 30.4 percent of the workforce. To be effective and productive, today's mobile worker increasingly relies on network connectivity to access e-mail, Internet, mobile applications, centralized databases, conferencing and content-management systems, to name but a few. As a result, the ability to provide Wi-Fi access and associated applications via indoor and outdoor wireless networks is becoming increasingly important.

With growing worker mobility requirements, carriers and enterprises must identify and implement network solutions that best meet the needs of business and users alike. The Motorola Wireless Network Solutions (WNS) portfolio offers innovative products to address these network access needs.

With a Wi-Fi network, businesses can increase the efficiency of their mobile employees resulting in increased ROI and greater profitability. This document highlights two specific indoor/outdoor Wi-Fi network configurations based on Motorola's Mesh Wide Area Network (MWAN) AP 7181 product solution.

**INDOOR/OUTDOOR DEFINED:**

An indoor/outdoor wireless network allows users to access pervasive wireless LAN and wireless broadband coverage and connectivity throughout a campus environment. This document details two of the most common network configurations.

**The first scenario (scenario A – Primary Indoor)** addresses the extension of coverage from an established indoor wireless network to an outdoor area. The indoor wireless network can be an industrial space such as a warehouse or a medical facility and the outdoor network could encompass a parking lot, business campus or outdoor storage area.

**The second scenario (scenario B – Primary Outdoor)** expands wireless coverage from an outdoor wireless network to an indoor wireless network. The outdoor wireless network can be a large campus or citywide wireless broadband network. The indoor wireless network originates in a residence or a small business.

**Indoor To Outdoor Coverage, Enterprise Warehouse**



**SCENARIO A: INDOOR TO OUTDOOR COVERAGE, ENTERPRISE WAREHOUSE:**

In this scenario, Wi-Fi coverage is extended from an established indoor wireless network in a large retail warehouse to an outdoor area that includes a storage facility and/or adjacent parking lot. Often the driver for these networks is the need for users to seamlessly maintain access to critical business communications and applications such as inventory management and tracking systems as well as access to internal databases whether they are indoors or out. The AP 7181 offers an effective scalable solution for outdoor broadband networks and is compatible with existing Wi-Fi devices.

**EQUIPMENT NEEDED:**

As highlighted above, the indoor network is the primary established network, which is usually comprised of enterprise Wi-Fi access points managed by a wireless switch and the existing infrastructure needed to support a corporate or enterprise indoor network. Aside from the wired elements, this would also include a Network Management Server, a series of routers or L3 Switches and potentially an AAA or Radius Server for secure access. The AP 7181 provides the outdoor coverage extension. The AP 7181 is connected to the indoor network via a router or a L3 switch, which is common to both networks. This type of coverage extension is cost effective in that the wireless elements augment the existing network infrastructure and many of its core components – such as the security protocols -- can be shared between the networks.

**SCENARIO B: OUTDOOR TO INDOOR COVERAGE FOR RESIDENTIAL AND SMALL BUSINESSES:**

Cities often deploy wireless broadband networks to support city services. Everyone from city managers to heads of individual departments is developing ways to make their city smarter and more digital. Private wireless broadband networks offer a backbone that supports a wide range of new applications and advanced services. These Municipal Services Networks are no mere investment in technology for its own sake, but a strategic deployment to deliver better public services more efficiently. A Municipal Services Network can offer many benefits to a city such as:

- Improved public safety through video surveillance
- Reduced resource consumption by implementing smart meters for gas, electric and water utilities
- Reduced commute times and pollution as well as increased safety through traffic light optimization.
- Improved public transit reliability and increased ridership through consumer services like on-board Wi-Fi.
- Giving emergency response workers real-time access to critical information in the field.
- Public works personnel dispatched more efficiently based on their proximity to the next dispatch site.
- Field workers save money and improve response times by filing reports and accessing database information from their vehicles.

In unlicensed Municipal Services Networks, operators can generate additional revenue by bringing outdoor coverage to indoor environments such as residential homes and small businesses. In this scenario, the outdoor wireless network is the primary network. In order to extend coverage indoors, an indoor Wi-Fi based access point gateway, also known as a Wi-Fi CPE (Customer Premise Equipment) device, must be installed. The Wi-Fi CPE is used to connect the wireless signal from the outdoor network to the indoor network.

The wireless outdoor network is built off of a primary backbone typically managed and owned by the city. The indoor CPE links to the outdoor AP 7181 and provides connectivity to the home user through a Wi-Fi or Ethernet connection. The residential traffic is bridged through the indoor CPE, across the mesh link, to the AP 7181 where it eventually connects to the Internet or its selected destination.

In the previous diagram, the outdoor network is represented on the right. For the indoor network, two scenarios are represented: a residential home on the lower left and a small office on the upper left.

**REQUIRED EQUIPMENT:**

In the outdoor network, several AP 7181 nodes are deployed. The MWAN AP 7181 root node is connected to an Ethernet backhaul, which provides access to the Internet. The Ethernet backhaul is connected to the remainder of the wired network, which can include additional routers providing final connectivity to the Internet Service Provider (ISP). In the Network Operations Center (NOC), Motorola's Wireless Manager network management software is present along with the other network management systems to monitor configuration, performance and security elements.

If there is a large distance between the Ethernet backhaul and the AP 7181 root nodes, Motorola has a solution that will extend the backhaul wirelessly. Motorola's Point-to-Multipoint product line allows for backhaul extension up to several miles. Alternatively, Motorola's Point-to-Point product can be used when longer distances (i.e. over 150 miles with line of sight) or higher bandwidths are required.

Two types of users (residential and small businesses) can take advantage of the Wi-Fi coverage highlighted in this scenario. Residential home networks typically consist of one indoor Wi-Fi access point or an indoor Wi-Fi-based CPE. The Wi-Fi CPE serves the dual purpose of providing Wi-Fi coverage indoors and routing the traffic to the outdoor mesh AP 7181 network. Alternatively, some Wi-Fi CPEs will only allow the user to connect directly to the CPE via Ethernet. These CPEs are called indoor Wi-Fi bridges and they allow connectivity by simply bridging the traffic from the outdoor AP 7181 to the indoor CPE device. This scenario would be typical for a user who desires Internet connectivity but not indoor wireless connectivity.

The network configuration for a small office network would consist of two Wi-Fi meshed CPE units. One CPE unit connects the outdoor network to the indoor network while also providing indoor Wi-Fi coverage. The additional CPE would be used to cost effectively extend coverage indoors. This scenario offers an attractive solution for small businesses looking to utilize Wi-Fi coverage as a backup to an existing network. For example, if the primary indoor network is provided by an ISP, the small business can use the Motorola indoor/outdoor network as a backup or secondary network if the primary network becomes inoperable.



**Indoor To Outdoor Coverage Extension For Residential And Small Businesses Warehouse**

By utilizing the high performing outdoor 802.11n wireless AP 7181 nodes, a network operator has the capability to expand and extend the network from inside-out or outside-in as requirements demand.



**KEY CONSIDERATIONS FOR INDOOR/OUTDOOR NETWORK CONFIGURATIONS: MANAGEMENT, SECURITY, ROAMING**

Regardless of which network scenario is implemented, network operators – carriers, enterprise or private – need to take three key elements of network configuration and capability into consideration to achieve optimal indoor-outdoor wireless broadband coverage: network management, security and roaming.

**NETWORK MANAGEMENT:**

Network management is a critical capability for operators of any deployed network. Scalability, monitoring, control, auto discovery and reporting are but a few considerations operators need to assess when evaluating options. In the Outdoor to Indoor Network Scenario highlighted above, MWAN AP 7181 nodes are managed by Motorola's Wireless Manager (WM), allowing operators access to real-time advanced visualization of core network components in an embedded Google Earth environment. It also automatically populates exported network/device type and location data directly from programs such as BroadbandPlanner, which is used to design, measure and verify outdoor wireless mesh networks cost effectively and efficiently.

In an indoor to outdoor scenario, the indoor network will use the manufacturer's specified management system to operate, provision and monitor the indoor Wi-Fi access points and other network components. The MWAN AP 7181 units in the outdoor wireless network are managed by Motorola's Wireless Manager and the indoor wireless network uses the AirDefense Services Platform (ADSP).

**SECURITY:**

Whether addressing the needs of residential, small business, municipal services or enterprise networks, both the AP 7181 and enterprise Wi-Fi products must support a common protocol for security such as WEP, WPA and WPA2 in order to enable client access.

The AP 7181 product supports WEP, WPA, 802.11i and WPA2 and Motorola's Secure Mesh for inter-nodal communications, which is analogous to WPA2, the highest level of security. Most indoor Wi-Fi based CPEs on the market today also support WEP, WPA and WPA2. In order to communicate from the outdoor AP 7181 network to the indoor network, it must be designed with common parameters including IP subnet, security types and SSIDs. When properly deployed and configured, the indoor and outdoor coverage appears as a single continuous network to the user.

In addition, a Radius Server or an AAA server can be used for secure access to the network. These components can be shared between the two networks allowing for greater ROI and operational efficiencies. The network operator would maintain a central database for authentication, authorization and accounting, allowing for the configuration and maintenance of one security access console.

**NETWORK ROAMING:**

The ability for a user to move from one portion of the network to another is constrained by certain design conditions. A Wi-Fi client moving from a home or business environment can roam to the outdoor network and vice versa if the network is designed with the following considerations:

- Both the AP 7181 units and the indoor CPE utilize the same IP subnet
- Both the AP 7181 units and the indoor CPE have the same SSID
- Both the AP 7181 units and the indoor CPE have the same security configuration (WEP, WPA or WPA2)
- The indoor Wi-Fi CPE lies within the same RF boundary as the nearest outdoor AP 7181.

Meeting all of these conditions will allow a client device to transition from one network to another seamlessly without having to re-associate to the new network. This is of particular importance for an indoor-out network configuration in an enterprise or healthcare environment. If a network does not meet these requirements, the client will experience a disruption of connectivity due to either having to re-associate to the nearest AP or re-acquiring a new IP address from the DHCP Server. This could take 30 seconds or longer depending on how the network is provisioned.

If a client does not have the proper security authorization to associate to the new network, connectivity will be lost entirely. Additionally, other product limitations or compatibility issues could limit the ability for seamless roaming.

## WHITE PAPER

MOTOROLA'S WIRELESS BROADBAND INDOOR/OUTDOOR SOLUTION

### SUMMARY

The MWAN AP 7181, in combination with devices from Motorola and other manufacturers, can cost effectively address the needs of today's wireless broadband network operators and the increasing access requirements of mobile workers. By utilizing the high performing outdoor 802.11n wireless AP 7181 nodes, a network operator has the capability to expand and extend the network from inside-out or outside-in as requirements demand. As enterprise and municipal services networks increase their reach and capacity, so too do the businesses and users that rely on them. By leveraging the flexibility and scalability of indoor/outdoor broadband network configurations, and advanced network management tools, operators can deliver enhanced network capabilities, greater management efficiencies and increased return on investment.

#### **ADDITIONAL INFORMATION:**

Please visit the following site to receive additional information:

#### **Mesh Wide Area Network Product Line, including the AP 7181:**

<http://www.motorola.com/mesh>



[motorola.com/mesh](http://motorola.com/mesh)

Part number WP-INDOOR/ OUTDOOR. Printed in USA 08/10. MOTOROLA, MOTO, MOTOROLA SOLUTIONS and the Stylized M Logo are trademarks or registered trademarks of Motorola Trademark Holdings, LLC and are used under license. All other trademarks are the property of their respective owners. © 2011 Motorola Solutions, Inc. All rights reserved.

GO-25-111 B